



An Energy Efficiency Workshop & Exposition

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Palm Springs, California

*Please be courteous to our speakers*



***Turn off all cell phones  
and  
Set pagers to vibrate***





An Energy Efficiency Workshop & Exposition

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Palm Springs, California

## *The Presidio of San Francisco*



How to Achieve Energy Efficiency

Within a Historic Framework



## ***The Presidio Trust***

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# ***The Presidio Community***

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***NATIONAL HISTORIC LANDMARK***

***OVER 800 BUILDINGS (RESIDENTIAL AND  
NON-RESIDENTIAL)***

***OVER 400 HISTORIC BUILDINGS***

***FIRE AND POLICE***

***COMPLEX UTILITIES SYSTEMS***





# ***Presidio Utility System***

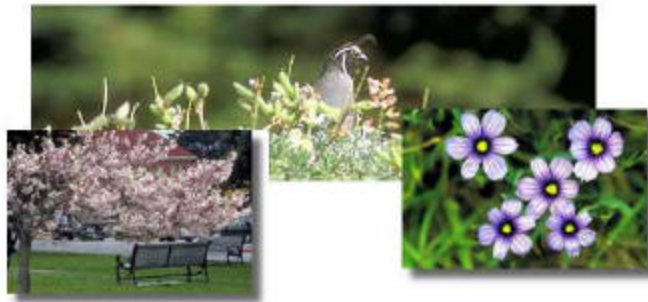
## **Inherited Infrastructure**

- The system was designed to support an Army Base, it must be upgraded to support a mixed use facility.
- The system is old - many portions are over 60 years old.
- Little to no record drawings of infrastructure.



## **Constraints**

- Presidio is a Historic Landmark - archeological features are everywhere.
- The land has been environmentally impacted by previous operations (currently under remediation).
- The Presidio is restoring many of the natural resources (plants & wild life).





# *High Voltage System*

## *System Overview*

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- The Trust inherited a 45-mile electrical distribution system that was in real poor condition.
- Power enters the Presidio at two locations and is at 12,000 volts.
- The 12 kV primary runs to five substations where it is reduced to 4.16 kV - it is then distributed to all buildings where it is further reduced to a 120/208 volt secondary service.
- Approximately 60% of the distribution system consists of overhead lines and 40% is underground.
- Since we operate in a park that has many trees, we are constrained by bird nesting season requirements. It is crucial to perform tree trimming maintenance regularly. Most of the power outages that occurred when the Trust first assumed maintenance were due to poorly trimmed trees crashing on electric wires.
- Real time monitoring of Electrical power resources begins at these points of entry locations with our Johnson Controls Energy Management and Controls System (EMCS).



# ***High Voltage System***

## ***Energy Efficiency Improvements***

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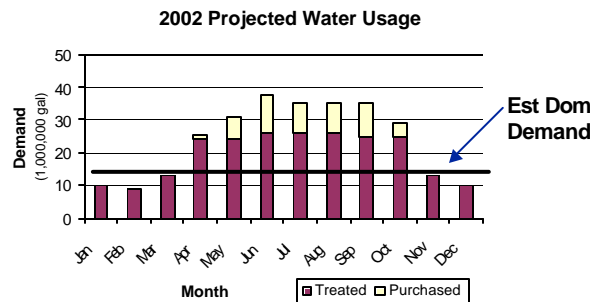
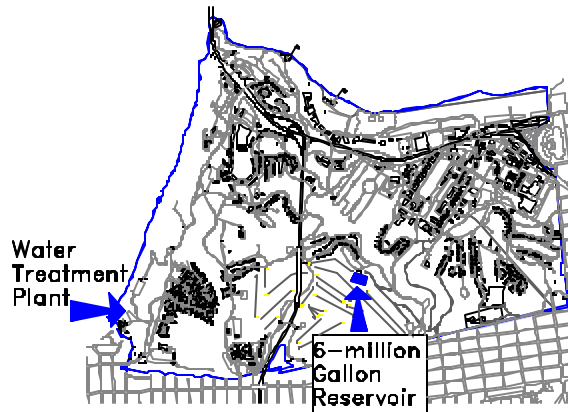
- Replaced old, inefficient transformers with high efficiency transformers. All new transformers are now properly sized for load.
- Installed high efficiency lamps in street lights.
- Installed electric meters on all residential and non-residential units.
- Installed astronomical timers on 10 street light circuits - timers automatically adjust for the changing daylight hours. This was funded by Pacific Gas and Electric (PG&E), our local utility.
- Installed real time meter on incoming 12 kV lines.
- Balanced the loads on the existing transformers to achieve a greater transformer efficiency.





# Potable Water System

## System Overview



- Lobos Creek is the Treatment Plant's primary water source and is the last free flowing creek in San Francisco.
- There is over 47 miles of distribution system pipes ranging in sizes up to 18-inches.
- Portions of the distribution system are over 60 years old.
- Original Treatment Plant was constructed in 1910 and modernized in 1998 to a 2.0 million gallon per day Plant.
- The Plant is permitted by California Department of Health Services.
- Finished water meets all California Clean Drinking Water requirements.
- The Presidio has a large irrigation demand accounting for 47% of all water consumption.
- Lobos Creek provides 83% of Presidio water needs, supplemental water is purchased from San Francisco.



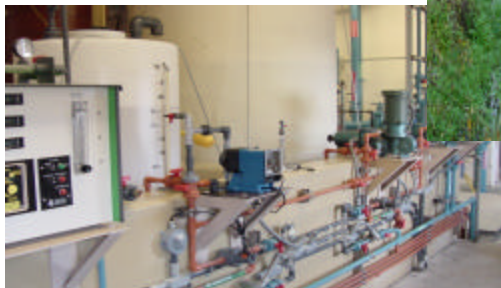
# ***Potable Water System***

## ***Energy Efficiency Improvements***

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LOBOS CREEK  
SPRING WATER



- Identified and eliminated over 20 major system leaks.
- Projects not only increased energy efficiency of system, but improved system reliability and water quality.
- Installed water meters on all non-residential units and new irrigation systems.
- Installed low flow toilets, shower heads, and aerators on both non-residential and residential units.
- Refitted plant with energy efficient pumps. Project partially funded by PG & E.
- Altered plant operations to operate 200 hp pumps during non-peak times.
- Programmed automated sprinkler systems to operate on a sprinkle and soak method - 5 minutes on, 20 minutes off. This eliminates the amount of irrigation runoff.





# ***Sanitary Sewer System***

## ***System Overview***

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To San Francisco  
East Sewer System  
Approx 9.5 million  
Gallons per Month

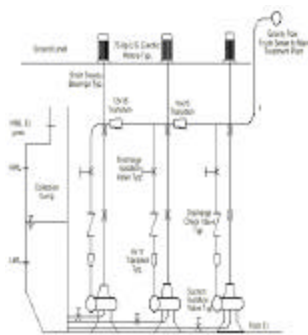
To San Francisco  
West Sewer System  
Approx 4.1 million  
Gallons per Month

- The Presidio has separate sewer systems, one for sanitary sewage and one for storm water.
- Over 36 miles of sanitary sewer main lines and 775 service lines.
- Seven sanitary sewer lift stations - all in need of repair.
- Manholes cracked and leaking sewage.
- Slip line pipes improperly installed resulting in large amounts of groundwater infiltration.

- Many of the service lines and manholes had massive root intrusion.
- There were many storm water pipes tied into the sanitary sewer which increased discharge to San Francisco sewer system.
- 90% of all storm water outfalls into San Francisco bay destroyed by storms. Massive flooding in low lying areas.

## ***Sanitary Sewer System***

## Energy Efficiency Improvements



- **Projects not only increased energy efficiency of sewer system, but improved system reliability and environmental quality.**
- **Installed a flow meter to track all discharge to San Francisco system.**
- **Rehabilitated lift stations with improved controls system.**
- **Installed high efficiency impellers on sewer pumps - decreased run time by 50%.**
- **Eliminated all storm sewer connections and repaired most of the slip lined pipe infiltration - this reduces the discharge of clean water to the San Francisco sewer system.**
- **TV inspected over 70% of sanitary sewer system and used pressure grouting to repair leaks in clay pipe.**



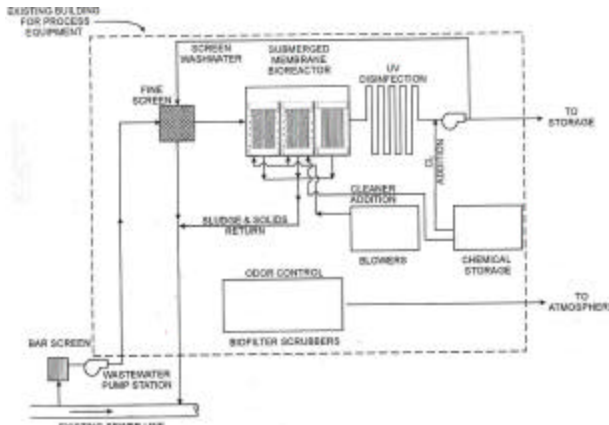
# Recycled Water System

## Project Description

- The system will extract wastewater from the sanitary sewer system, process it to meet state requirements, and then use it for irrigation.
- Treatment system will use membrane filtration and be approved by the California Department of Health Services.
- Phase I will be a 200,000 gallon per day system, and Phase II will increase it to 500,000 gallons per day.
- Environmental Assessment and Project Plan already complete.

## Project Benefits

- Recycled water will supplement potable water supply.
- Reduce energy needed to process potable water and energy needed to treat sewage.
- Reduce sewer discharge to San Francisco sewer system.





# Other Utility Functions

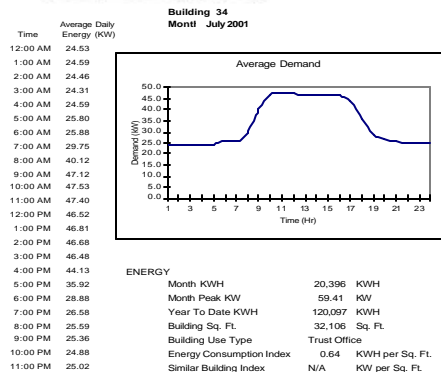
## Waste Management

- Presidio manages all residential, non-residential, and construction waste streams.
- Recycling efforts have achieved 54% diversion from the residential waste stream



## Natural Gas

- Presidio Trust works very closely with PG&E to monitor usage on over 1,200 metered accounts.
- Presidio Trust is contracting with GSA for the procurement of natural gas.



## Utility Billing

- Presidio bills all non-residential tenants for utility service.
- Presidio utility rates are the same or lower than area wide utility rates (Bench mark pricing).
- RF water and electric meters installed on residential units.
- Electric energy reports are included in non-residential utility bills



# ***Energy Monitoring and Control System (EMCS)***

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## **Presidio EMCS - Energy Monitoring**

- Johnson Controls Metasys based system installed in 1999. Technical assistance provided through a DOE-FEMP grant.
- Allows Trust to monitor all 12 kV electrical power coming into the Presidio at 10 minute intervals.
- Allows Trust to monitor electrical demand and consumption at over 75 non-residential units.
- Allows Trust to also monitor a buildings natural gas or BTU consumption on a real time basis.
- Energy use information made available to tenants.



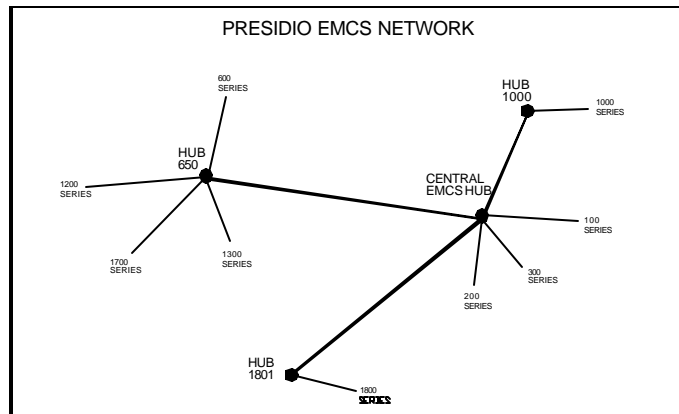
## **Presidio EMCS - Energy Controls**

- Able to regulate and control efficient operation of a 7 MM BTU central boiler system and many individual boiler systems.
- Local EMCS boiler controls regulate operation based on outside air temperature and time.
- Able to control individual building light circuits.
- Able to control boiler operation in conjunction with Co-gen units.





# ***Energy Monitoring and Control System (EMCS)***



## **EMCS Operator Work Station**

- **Operator Work Station (OWS) is the main control point for the entire EMCS.**
- **The OWS is maintained by a specialist trained in the Metasys EMCS.**
- **Due to the size of the Presidio, an OWS was installed at each remote HUB.**

## **Presidio EMCS Network**

- **This is a large (distance) system - had to rely on existing infrastructure to go on-line.**
- **Installed system over existing telephone wires with the use of a modem.**
- **Problems in system worked out by Trust EMCS operator and DOE-FEMP.**
- **Creation of local HUBS reduces congestion on system and takes advantage of fiber optic lines.**





## ***Distributed Generation Pilot Projects***

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- **5 kW Photo Voltaic System**
- **Micro Co-Generation**
- **Solar Powered Street Lights**



## ***5 kW Photo Voltaic Pilot Project***

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- **Pilot project designed to evaluate the use of photo voltaic cells as a viable distributed generation resource at the Presidio**
- **Issues of Concern**
  - **Amount of power output from a 5 kW rated system in San Francisco**
  - **Capital cost and available funding.**
  - **Operation and Maintenance costs**
- **Project scheduled to go on line June 15, 2002**



# ***Micro Co-generation Pilot Project***

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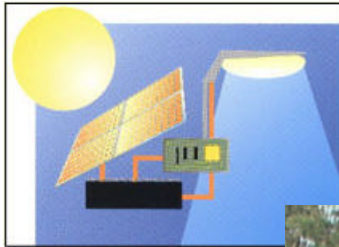


- Pilot project designed to see the use of micro co-generation units are a viable alternative energy source for the Presidio.
- Issues of Concern
  - Tying in to an existing historic building.
  - Costs (initial cost, funding, permitting)
  - Efficiency and recoverable heat output.
  - Operation and maintenance costs.
- Findings
  - Selected Capstone 330 for micro turbines and Unifin heat recovery unit for hot water heating.
  - Works well in existing buildings.
  - Interconnectivity with local utility is a long and complicated process, so start early.
  - Units rated as requiring low gas pressure (0.25 psi) however higher pressure is needed.



# ***Solar Powered Streetlight Pilot Project***

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## Solar Powered Streetlights

- **Pilot project designed to see if Solar Powered Streetlights are a viable alternative energy source for the Presidio.**
- **Issues of Concern**
  - Ability to operate in San Francisco fog.
  - Light output.
  - Capital cost and available funding.
  - Operation and Maintenance costs.
- **Findings**
  - Worked well in fog and high wind conditions, units are heavy, install on a high strength pole.
  - Adequate light output for residential areas and other uses.
  - High first cost and we were unable to locate funding opportunities.
  - Great for areas where there is no infrastructure and lighting is required - bus stops, remote restrooms and informational kiosks.



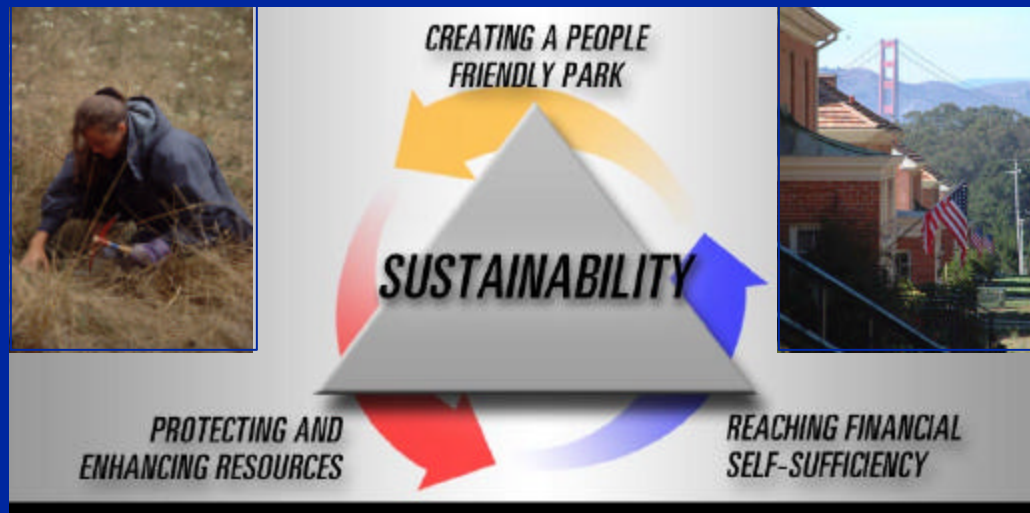


## ***Lessons Learned***

- **Develop a good plan before starting any project.**
- **Get to know your local utility representative.**
- **Don't be afraid to ask other federal agencies (DOE, FEMP) for assistance.**
- **Have a motivated team, energy management and conservation is a team effort.**
- **Share your experiences with others.**



## *The Presidio Trust*



### ***Sustainability Means Balancing...***

- ***Economic Concerns- Financial Self-Sufficiency***
- ***Social Concerns- Creating a People-Friendly Park***
- ***Environmental Concerns- Protecting and Enhancing Resources***



## *Green Building & Historic Preservation*

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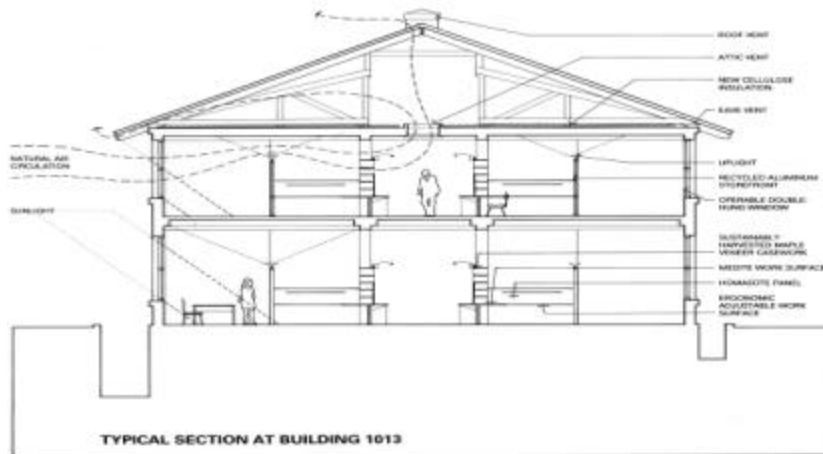


### *Principles*

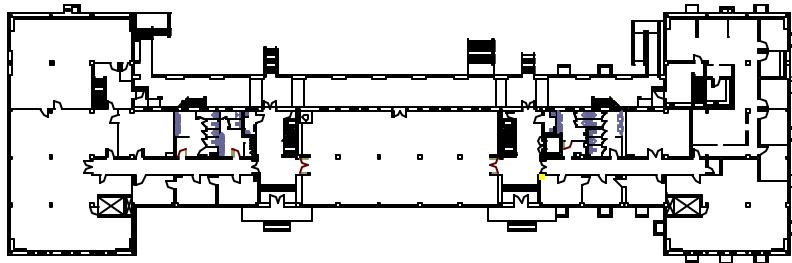
- ***Make it Easy to Be Green- Accessible Information and Resources***
- ***Capitalize on Existing Building's Benefits***
- ***Preserve Historic Fabric and Features***
- ***Select Compatible Green Building Materials***
- ***Retrofit for Energy and Water Efficiency***
- ***Salvage and Recycle***



## Green Building & Historic Preservation



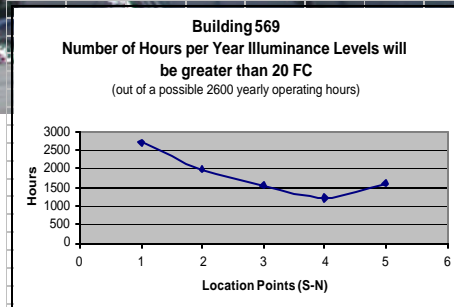
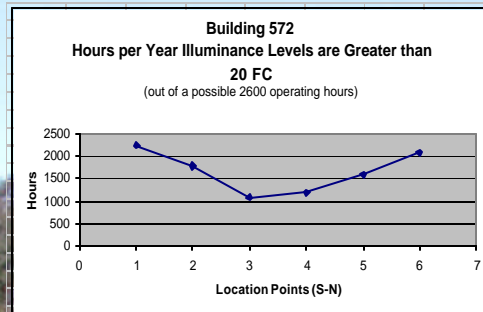
*Capitalize on Building's Benefits*



- **Natural Ventilation**
- **Operable Windows**
- **Access to Daylight**
- **Passive Ventilation Features**
- **Sun Shading Devices**



## Green Building & Historic Preservation



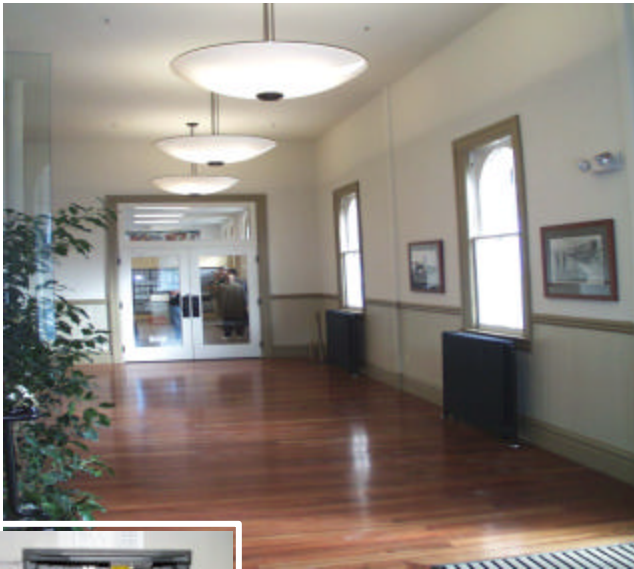
## PG&E Day-lighting Analysis

- *Allow site & building to influence lighting design*
- *Collect light level data*
- *Determine interior light levels w/computer modeling*
- *Use photocells and occupancy sensors*





## *Green Building & Historic Preservation*



### *New Buildings Systems: Lighting and*



- *Energy efficient lighting and occupancy sensors*
- *Efficient heating systems with new efficient boilers and thermostats*
- *Energy management and control systems.*



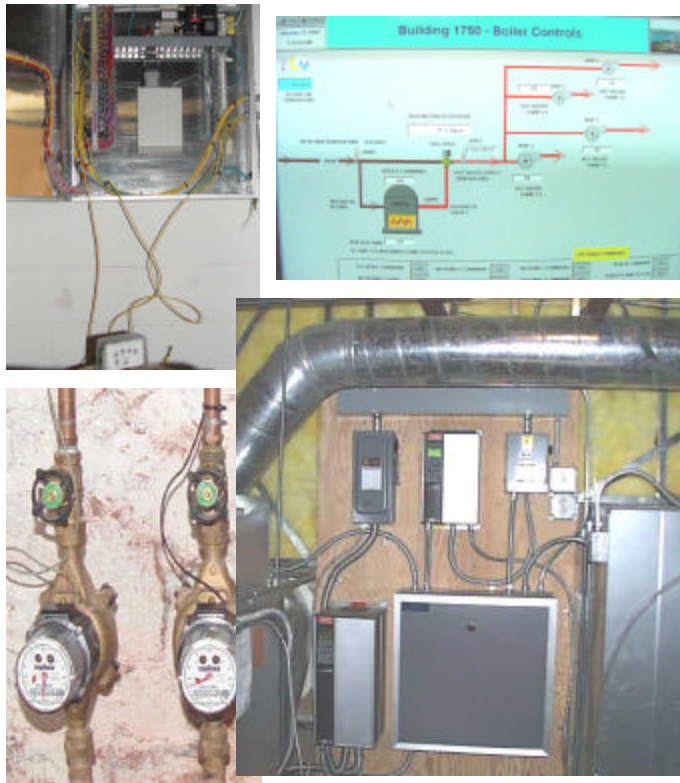


# ***Energy Monitoring and Control System (EMCS)***

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## **EMCS Local Systems**

- ***Each building contains a DX-9100 (basically a computer) which houses the modem and communication port..***
- ***Local DX-9100 units have been programmed to:***
  - ***Monitor Electricity***
  - ***Control Lighting***
  - ***Monitor Outside Air Temperature (OAT).***
  - ***Monitor and control zone temperatures.***
  - ***Control boiler operations.***
  - ***Monitor gas, water, and BTU meters.***





## *Green Building & Historic Preservation*



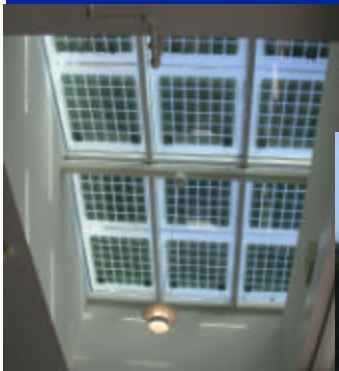
- ***Energy/Water Efficient***
- ***Natural & Renewable***
- ***Salvaged & Recycled***
- ***Certified Sustainable***
- ***Biodegradable/Non-toxic***



## *Green Building & Historic Preservation*



### *Select Compatible Materials*



- *Appropriate in Scale, Color, Texture*
- *Reversible Treatments*
- *Compatible with the Character of the Historic Resource*





## *Green Landscape and Irrigation*

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- *Drought-tolerant plants and native species, compatible with historic plant lists*
- *The use of compost and mulch to retain soil moisture*
- *Water conserving irrigation systems*
- *Purple pipe for future reclaimed water*
- *Green site furnishings and accessories*



## *Energy Retrofit Project*

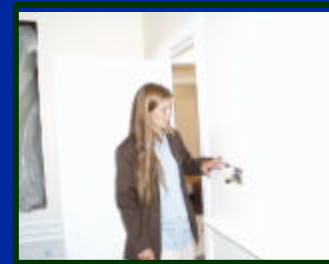


### **Summer Initiative Lighting and Equipment Retrofit Project**

- ***\$500,000 - California Public Utilities Commission Grant***
- ***Resulted in an Energy Savings of over 1 Million kW per year***
- ***And Annual Cost Savings of \$165,000***



## *Working With Partners*



### ***Working with Partners***

- ***Department of Energy- Federal Energy Management Program***
- ***National Labs- Technical Assistance***
- ***Local Utility- Pacific Gas and Electric***
- ***California Public Utilities Commission***





## *Changing Behavior*



***Demand Reduction Program- California Independent Service Operator***

***Reducing our Peak Demand- (Water Treatment, Vehicle Charging)***

***Public Information- (System for alerting staff and tenants to power down)***

***Education Campaigns and Events***



## *Presidio Trust Energy Savings Initiatives*

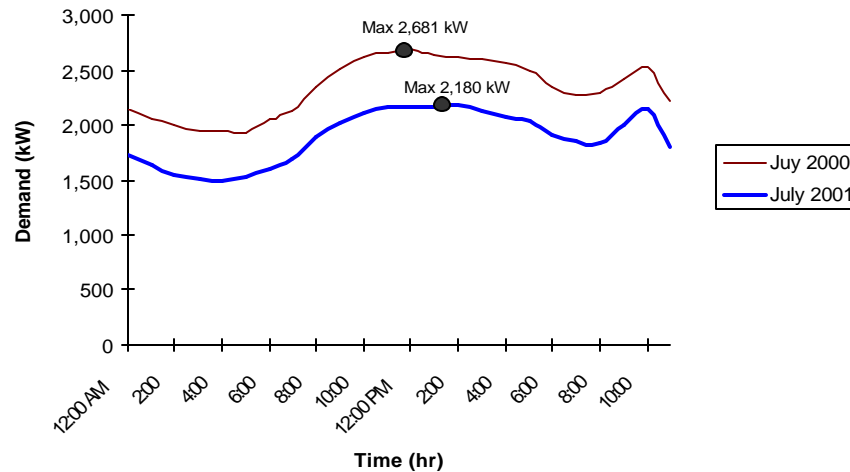
**The following highlights the general areas where the focused its energy efficiency efforts during the past three years:**

- ***Electric Utility Infrastructure Improvements***
- ***Water Savings and Wastewater Discharge Reduction***
- ***Comprehensive Energy Management and Control Systems***
- ***Green Building Policies and Practices***
- ***Lighting, Heating and Plumbing Retrofits***
- ***Pilot Projects***
- ***Education of Staff, Tenants and Residents***
- ***Team Work – Team Work – Team Work!***



# Energy Savings

**Total Average Weekday Power Demand**  
(July 2001 vs. July 2000)



## ***Energy Achievements***

- ***Significant Reductions in Peak Demand***
- ***20% Overall Reduction in Energy Consumption from 2000-2001***
- ***Energy Reductions Despite Increased Occupancy***



## **Contacts**

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